PATENT ABSTRACTS OF JAPAN

(11)Publication number : 05-166712
(43)Date of publication of application : 02.07.1993

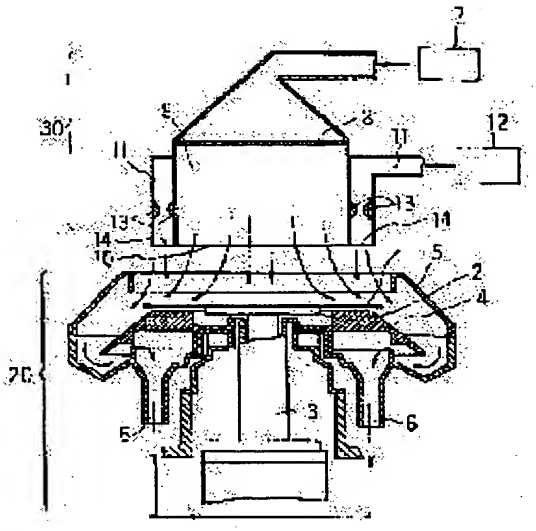
(51)Int.CI. H01L 21/027
B05D 1/40
G03F 7/16

(21)Application number : 03-335061
(22)Date of filing : 18.12.1991

(71)Applicant : DAINIPPON SCREEN MFG CO LTD
(72)Inventor : YABE MANABU

(54) SPIN COATING METHOD

(57)Abstract:
PURPOSE: To form an even film by supplying a substrate with the air current so controlled that the temperature and humidity are different for each area divided along the rotational radial direction of the substrate.
CONSTITUTION: An air current supply duct device 30 is provided with a cylindrical central part air current supply duct 9 which supplies around the central part on the surface of a wafer 1 with air current and a peripheral part air current supply duct 11 which supplies around the peripheral part on the surface of the wafer 1 with air current. The respective air current so controlled that the temperature and humidity are different is supplied to the wafer 1 from the central part air current supply duct 9 and the peripheral part air current supply duct 11 for forming a film of even thickness.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The revolution method of application characterized by to supply to a substrate the air current which were classified in the radius-of-gyration direction of a substrate, and which was controlled so that the both sides of temperature and humidity differed for every field with a division charging means have the air supplying opening divided in the shape of a concentric circle to the center of rotation of a substrate in the revolution method of application which forms a thin film on a substrate with the coating liquid supplied to the substrate by rotating a substrate.
[two or more]

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the revolution method of application which supplies air currents, such as pure air, from the upper part of a substrate, and makes thickness of a thin film homogeneity especially about the revolution method of application which applies coating liquid, such as photoresist material, SOG material, and dopant material, to various kinds of substrates, such as a semi-conductor wafer, a glass substrate for liquid crystal displays, a glass substrate for optical disks, and a glass substrate for photo masks.
[0002]
[Description of the Prior Art] In case revolution spreading of the coating liquid is carried out from the former at a substrate, a general inclination makes homogeneity the surrounding environmental conditions (temperature, humidity, wind speed, etc.) of a substrate as much as possible. However, since extent of the wind end by the core and periphery of a substrate differs, an environmental condition is not necessarily actually fixed in a revolution of a substrate, even if it only makes the surrounding environmental condition of a substrate into homogeneity on a substrate front face. For this reason, comparatively, by the periphery, the operation which the solvent component of coating liquid tends to volatilize, a diffusion fluidity falls since it is in a situation on the front face of a substrate which supplied coating liquid with viscosity high as a result, and is shaken off with a centrifugal force may fall, and the film may become thick by the periphery. Moreover, even if a diffusion fluidity falls similarly in a certain case, the coating liquid which has coating liquid which has dispersed with the centrifugal force in the periphery of a substrate may be pulled strongly, and the film may become thin by the periphery at reverse.
[0003] Especially, recently, it is becoming still more difficult with diameter[of macrostomia]-izing of substrates, such as inch[8]-izing of a semi-conductor wafer, to form the thin film of thickness uniform only by making the surrounding environmental condition of a substrate into homogeneity.
[0004] Then, what forms uniform thickness by controlling the flow rate of the air current from the upper part of a substrate as an approach of making thickness homogeneity (JP,63-72373,A) is proposed. By establishing a truncated-cone-like guide means, dividing an air current into plurality so that the upper part of a substrate may be covered for the perimeter of a substrate in a wrap cup, and controlling the flow rate of each air current by the flow regulation means, this tends to supply an air current so that a flow rate may be differed in the radius-of-gyration direction of a substrate, and it is going to form uniform thickness all over a substrate.
[0005] Moreover, the technique given in JP,62-225268,A is known as other conventional examples. This technique tends to improve the homogeneity of thickness by establishing the exhaust air structure which controls the direction which exhausts independently the washing gas once supplied to the substrate, and displacement.
[0006]
[Problem(s) to be Solved by the Invention] However, if it is in such the conventional method of application, it has the following troubles.
[0007] That is, although an air current is divided into plurality, the flow rate of each air current is

controlled or the exhaust air direction and displacement of an air current are controlled independently, the Prior art is difficult for controlling the flow rate and displacement of an air current as it was meant so that uniform thickness might be formed actually. A different air current of the plurality by which a flow rate and displacement were controlled on the substrate undertakes effect mutually, and, as for this, it has become a cause that control of the flow rate of an air current or displacement is less than the front face of a substrate. Consequently, there is a problem that it is difficult to form uniform thickness only by supplying the air current which changed a flow rate and displacement in the radius-of-gyration direction of a substrate.
[0008] This invention is made in order to solve such a conventional trouble, and it aims at offering the revolution method of application which forms a uniform thin film by supplying to a substrate the air current controlled so that the both sides of temperature and humidity differed in the radius-of-gyration direction of a substrate.
[0009]
[Means for Solving the Problem] In order to attain the above-mentioned object, the revolution method of application concerning this invention In the revolution method of application which forms a thin film on a substrate with the coating liquid supplied to the substrate by rotating a substrate He is trying to supply to a substrate the air current which were classified in the radius-of-gyration direction of a substrate in the shape of a concentric circle and which was controlled so that the both sides of temperature and humidity differed for every field with a division charging means to have the air supplying opening divided in the shape of a concentric circle to the center of rotation of a substrate. [two or more]
[0010]
[Function] Since the air current which were classified in the radius-of-gyration direction of a substrate and which was controlled so that the both sides of temperature and humidity differed for every field is supplied to a substrate from the air supplying opening which the division supply means divided in the shape of a concentric circle to the center of rotation of a substrate according to the revolution method of application concerning this invention, the homogeneity of thickness can be raised. That is, since the perimeter of a substrate is usually in the condition of having been opened by atmospheric pressure, in the field on the substrate referring to such an air current when it is high in the humidity of an air current, namely, a water vapor pressure is made high in the part which has the air supplying opening made temporary by the two or more division here in the ambient atmosphere of an atmospheric-air open system since the total pressure is atmospheric pressure, if coating liquid is a hydrophilic property and it will be oleophilic, the steamy partial pressure of the solvent component will fall. On the other hand, if humidity of a charging style is made low, the steamy partial pressure of the solvent component of coating liquid goes up.
[0011] Moreover, in a part with an air supplying opening, in the field on the substrate which touches such an air current if temperature of a charging style is made high, if the steamy partial pressure of the solvent component of the coating liquid on a substrate goes up and temperature of a charging style is made low, the steamy partial pressure of the solvent component of coating liquid falls.
[0012] For this reason, by supplying the air current controlled in the part with the air supplying opening carried out by the two or more division to differ the both sides of temperature and humidity from other parts of an air supplying opening the conventional example -- ** -- extent which the solvent component of coating liquid evaporates in the field on the substrate which compares and touches such an air current -- changing -- the fluidity of the coating liquid in the field on a substrate -- other fields and homogeneity -- or it can be intentionally different.
[0013] Then, in a part with the air supplying opening carried out by the two or more division, by changing the both sides of temperature and humidity with other parts of an air supplying opening, it is canceled because canceling the ununiformity of the thickness by the fluidity of coating liquid being uneven by making the fluidity of coating liquid into homogeneity operates the fluidity of coating liquid intentionally so that the ununiformity of the thickness by elements other than a fluidity may also negate the element from the first.
[0014]

[Example] Hereafter, the example of this invention is explained based on a drawing. Drawing 1 is the sectional view of the 1st revolution coater used for the revolution method of application concerning this invention. This revolution coater mainly consists of a body 20 of a coater, and air-current supply duct equipment 30.

[0015] The body 20 of a coater is equipped with the spin chuck 2 which supports the semi-conductor wafer 1 (it is only described as a wafer below), the spindle 3 for rotating a wafer 1 by thousands revolutions, a rectification means 4 to prepare an air current in the lower part of a wafer 1, the cup 5 constituted so that a wafer 1 may be covered from a perimeter, and the exhaust port 6 which is open for free passage for the exhaust air means (not shown) for exhausting the air current in this cup 5. When it is arranged in the condition that the nozzle for coating liquid supply of a photoresist etc. (not shown) placed the delivery upside down, this nozzle moves above a wafer 1 when applying coating liquid on a wafer 1, and not applying above a spin chuck 2, it evacuates to the location on the side of a cup 5.

[0016] On the other hand, the air-current supply duct equipment 30 which divides and supplies an air current to the top face of a wafer 1 at plurality is formed above the body 20 of a coater. This air-current supply duct equipment 30 is equipped with the periphery air-current supply duct 11 on the front face of a wafer 1 which supplies an air current to a periphery comparatively while it is formed in the outside of the core air-current supply duct 9 of the shape of a cylinder on the front face of a wafer 1 which supplies an air current to a core comparatively, and this core air-current supply duct 9 in the shape of a concentric circle.

[0017] The center-section air-current supply duct 9 is opened for free passage by the 1st temperature and the humidity control unit 7, and the air current air-conditioned in this unit 9 passes the punching plate 8, and is mainly supplied toward the core of a wafer 1 from the 1st air supplying opening 10. The punching plate 8 prepared in the center-section air-current supply duct 9 is carrying out the role of the flow resistance for supplying an air current uniformly from the center-section air-current supply duct 9. Moreover, the 2nd temperature and the humidity control unit 12 are open for free passage, and the periphery air-current supply duct 11 is air-conditioning the air current so that the both sides of temperature and humidity may differ from the air current air-conditioned in above-mentioned 1st temperature and humidity control unit 7. And this air-conditioned air current passes a slit 13, and is mainly supplied toward the periphery of a wafer 1 from the 2nd air supplying opening 14. In the 2nd air supplying opening 14, this slit 13 carries out rate-limiting [of the air current in the periphery air-current supply duct 11], and it is prepared from the whole opening surface of the 2nd air supplying opening 14 so that homogeneity can be supplied if possible, so that it may not charge strongly only the neighborhood near the free passage section with the 2nd temperature and the humidity control unit 12.

[0018] Furthermore, a migration means (not shown) to move the air-current supply duct equipment 30 constituted as mentioned above to locations other than the upper part of a wafer 1 and the upper part is established. This migration means moves air-current supply duct equipment 30 above a wafer 1, when supplying an air current to a wafer 1, and when it does not supply, it is made to evacuate it to locations other than the upper part of a wafer 1.

[0019] In addition, the temperature of the air current supplied although the air current currently air-conditioned in the 1st temperature, the humidity control unit 7, and the 2nd temperature and a humidity control unit 12 is controlled so that the both sides of temperature and humidity differ, respectively is 20-30 degrees C, humidity is the range of 40 - 50%RH (relative humidity), and the rate of flow is 0. several m/min (dozens cm/min). It is desirable to make it extent.

[0020] Next, the revolution method of application concerning this invention using the revolution coater of the above 1st is explained. First, before starting a spindle 3, a wafer 1 is carried in in a revolution coater with the conveyance means which is not illustrated, and it lays on a spin chuck 2, and holds by performing vacuum adsorption etc. And a nozzle is moved above a wafer 1. At this time, air-current supply duct equipment 30 is evacuated to the location on the side of a cup 5, and extent which a wafer 1 moves [carrying in or / nozzle] in the upper location of a cup 5.

[0021] In this condition, the coating liquid of the specified quantity is applied on a wafer 1 from the delivery of a nozzle, and a nozzle is immediately evacuated from the wafer 1 upper part after

that. Or coating liquid is supplied operating a spindle 3 previously and rotating a wafer 1 comparatively at a low speed (for example, 1000 or less rpm), and a nozzle is immediately evacuated from the upper part of a substrate 1 after that. Then, the evacuated air-current supply duct equipment 30 moves above a wafer 1 with a migration means, and descends to about 20mm on the front face of a wafer 1 further.

[0022] Subsequently, the air current which were classified in the radius-of-gyration direction of a wafer 1 in the shape of a concentric circle and which changed the both sides of temperature and humidity for every field is supplied. for example, in being easy to evaporate a solvent component by the periphery of a wafer 1 as compared with the core of a wafer 1 In the relative comparison between the 1st and 2nd both temperature and humidity control unit beforehand An air current with low humidity is air-conditioned at an elevated temperature with the 1st temperature and the humidity control unit 7, and the humid air current is air-conditioned at low temperature with the 2nd temperature and the humidity control unit 12, respectively, and the air-conditioned air current is supplied to the core and periphery of a wafer 1, respectively. If it does so, it will cross all over a wafer 1 and evaporation of the solvent component from coating liquid will become homogeneity. On the other hand, most air currents supplied to the wafer 1 are exhausted from an exhaust port 6 by the exhaust air means.

[0023] In addition, since the both sides of temperature and humidity are somewhat mixed while flowing even to a wafer 1, in directly under [of the 1st air supplying opening 10 and the 2nd air supplying opening 14 / boundary], as for the air current supplied from the 1st air supplying opening 10 and the 2nd air supplying opening 14, the thickness of the coating liquid on a wafer 1 does not change suddenly. Moreover, although there is a possibility of producing the inconvenience by changing like producing the ununiformity of thickness when an air current is confused on the boundary of air currents where a flow rate is different, with a means to control the flow rate of an air current by the truncated-cone-like guide means like a Prior art, there is no possibility of producing turbulence of an air current in this invention controlled so that the both sides of temperature and humidity differ.

[0024] The above is the revolution method of application concerning this invention, as a result of evaporation of the solvent component from coating liquid becoming homogeneity, it goes across thickness all over a wafer 1, and it becomes homogeneity. In addition, what is necessary is for a process which supplies an air current to explain, after applying coating liquid on a wafer 1, but just to prepare above-mentioned this example more nearly up than the space where it is not necessary to make move air-current supply duct equipment 30 with a migration means, and is the upper part of a wafer 1 and a nozzle moves, where air-current supply duct equipment 30 is fixed when always supplying the air current which changed the both sides of temperature and humidity to the wafer 1.

[0025] Moreover, the revolution coater used for the revolution method of application concerning this invention can consider various equipments. Drawing 2 is the sectional view of the 2nd revolution coater used for the revolution method of application concerning this invention. A different point from the 1st revolution coater is a point of having formed the air-current exhaust duct 16 between the core air-current supply duct 9 and the periphery air-current supply duct 11. And the air current which was made into the shape of a concentric circle by the two or more division in the radius-of-gyration direction of a wafer 1 and which was controlled so that the both sides of temperature and humidity differed for every field is supplied with this revolution coater as well as the revolution method of application which used the 1st revolution coater. However, although most air currents supplied to the wafer 1 are exhausted from an exhaust port 6, it is exhausted by the exhaust air means which a part of air current does not illustrate through the slit 17 and damper 15 which are formed in the air-current exhaust duct 16 from an exhaust port 18. In addition, in order that a damper 15 may adjust an exhaust stream, the slit 17 is formed, respectively, in order to carry out rate-limiting [of the exhaust stream].

[0026] Drawing 3 is the sectional view of the 3rd revolution coater used for the revolution method of application concerning this invention. A different point from the 1st revolution coater is a point of having established from the perimeter the air-current supply duct 19 which supplies an air current for the air current air-conditioned in the 1st temperature and the humidity control

unit 7 to the body of coater 20 whole instead of and the body 20 of a coater for the wrap body material 21. [the center-section air-current supply duct 9] And in this revolution coater, the air current air-conditioned in the 1st temperature and the humidity control unit 7 passes the punching plate 8, and is supplied to the wafer 1 whole, and the air current air-conditioned in the 2nd temperature and the humidity air conditioning unit 12 is supplied to the annular field according to the plane view of the boundary of the core on a wafer 1, and a periphery through a slit 13.

[0027] Like [the revolution method of application using which revolution coater] the case where the 1st revolution coater is used, it goes across thickness all over a substrate, and it becomes homogeneity.

[0028]

[Effect of the Invention] Since the air current which were classified in the radius-of-gyration direction of a substrate in the shape of a concentric circle and which was controlled for every field so that the both sides of temperature and humidity differed is supplied according to this invention as explained above raising evaporation of a solvent component intentionally so that a certain element which it crosses all over a substrate, and evaporation of the solvent component from coating liquid becomes homogeneity, or makes thickness an ununiformity may be negated -- it can be made low, consequently the thin film of uniform thickness can be formed on a substrate.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Industrial Application] This invention relates to the revolution method of application which supplies air currents, such as pure air, from the upper part of a substrate, and makes thickness of a thin film homogeneity especially about the revolution method of application which applies coating liquid, such as photoresist material, SOG material, and dopant material, to various kinds of substrates, such as a semi-conductor wafer, a glass substrate for liquid crystal displays, a glass substrate for optical disks, and a glass substrate for photo masks.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art] In case revolution spreading of the coating liquid is carried out from the former at a substrate, a general inclination makes homogeneity the surrounding environmental conditions (temperature, humidity, wind speed, etc.) of a substrate as much as possible. However, since extent of the wind end by the core and periphery of a substrate differs, an environmental condition is not necessarily actually fixed in a revolution of a substrate, even if it only makes the surrounding environmental condition of a substrate into homogeneity on a substrate front face. For this reason, comparatively, by the periphery, the operation which the solvent component of coating liquid tends to volatilize, a diffusion fluidity falls since it is in a situation on the front face of a substrate which supplied coating liquid with viscosity high as a result, and is shaken off with a centrifugal force may fall, and the film may become thick by the periphery. Moreover, even if a diffusion fluidity falls similarly in a certain case, the coating liquid which has coating liquid which has dispersed with the centrifugal force in the periphery of a substrate may be pulled strongly, and the film may become thin by the periphery at reverse.
[0003] Especially, recently, it is becoming still more difficult with diameter[of macrostomia]-izing of substrates, such as inch[8]-izing of a semi-conductor wafer, to form the thin film of thickness uniform only by making the surrounding environmental condition of a substrate into homogeneity.
[0004] Then, what forms uniform thickness by controlling the flow rate of the air current from the upper part of a substrate as an approach of making thickness homogeneity (JP,63-72373,A) is proposed. By establishing a truncated-cone-like guide means, dividing an air current into plurality so that the upper part of a substrate may be covered for the perimeter of a substrate in a wrap cup, and controlling the flow rate of each air current by the flow regulation means, this tends to supply an air current so that a flow rate may be differed in the radius-of-gyration direction of a substrate, and it is going to form uniform thickness all over a substrate.
[0005] Moreover, the technique given in JP,62-225268,A is known as other conventional examples. This technique tends to improve the homogeneity of thickness by establishing the exhaust air structure which controls the direction which exhausts independently the washing gas once supplied to the substrate, and displacement.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, in this invention, the air current which were classified in the radius-of-gyration direction of a substrate in the shape of a concentric circle and which was controlled for every field so that the both sides of temperature and humidity differed is supplied. therefore, the thing for which evaporation of a solvent component is intentionally raised so that a certain element which it crosses all over a substrate, and evaporation of the solvent component from coating liquid becomes homogeneity, or makes thickness an ununiformity may be negated -- it can be made low, consequently the thin film of uniform thickness can be formed on a substrate.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, if it is in such the conventional method of application, it has the following troubles.
[0007] That is, although an air current is divided into plurality, the flow rate of each air current is controlled or the exhaust air direction and displacement of an air current are controlled independently, the Prior art is difficult for controlling the flow rate and displacement of an air current as it was meant so that uniform thickness might be formed actually. A different air current of the plurality by which a flow rate and displacement were controlled on the substrate undertakes effect mutually, and, as for this, it has become a cause that control of the flow rate of an air current or displacement is less than the front face of a substrate. Consequently, there is a problem that it is difficult to form uniform thickness only by supplying the air current which changed a flow rate and displacement in the radius-of-gyration direction of a substrate.
[0008] This invention is made in order to solve such a conventional trouble, and it aims at offering the revolution method of application which forms a uniform thin film by supplying to a substrate the air current controlled so that the both sides of temperature and humidity differed in the radius-of-gyration direction of a substrate.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] In order to attain the above-mentioned object, the revolution method of application concerning this invention In the revolution method of application which forms a thin film on a substrate with the coating liquid supplied to the substrate by rotating a substrate He is trying to supply to a substrate the air current which were classified in the radius-of-gyration direction of a substrate in the shape of a concentric circle and which was controlled so that the both sides of temperature and humidity differed for every field with a division charging means to have the air supplying opening divided in the shape of a concentric circle to the center of rotation of a substrate. [two or more]

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

OPERATION

[Function] Since the air current which were classified in the radius-of-gyration direction of a substrate and which was controlled so that the both sides of temperature and humidity differed for every field is supplied to a substrate from the air supplying opening which the division supply means divided in the shape of a concentric circle to the center of rotation of a substrate according to the revolution method of application concerning this invention, the homogeneity of thickness can be raised. That is, since the perimeter of a substrate is usually in the condition of having been opened by atmospheric pressure, in the field on the substrate referring to such an air current when it is high in the humidity of an air current, namely, a water vapor pressure is made high in the part which has the air supplying opening made temporary by the two or more division here in the ambient atmosphere of an atmospheric-air open system since the total pressure is atmospheric pressure, if coating liquid is a hydrophilic property and it will be oleophilic, the steamy partial pressure of the solvent component will fall. On the other hand, if humidity of a charging style is made low, the steamy partial pressure of the solvent component of coating liquid goes up.
[0011] Moreover, in a part with an air supplying opening, in the field on the substrate which touches such an air current if temperature of a charging style is made high, if the steamy partial pressure of the solvent component of the coating liquid on a substrate goes up and temperature of a charging style is made low, the steamy partial pressure of the solvent component of coating liquid falls.
[0012] For this reason, the thing for which the air current controlled in the part with the air supplying opening carried out by the two or more division to differ the both sides of temperature and humidity from other parts of an air supplying opening is supplied, the conventional example -- ** -- extent which the solvent component of coating liquid evaporates in the field on the substrate which compares and touches such an air current -- changing -- the fluidity of the coating liquid in the field on a substrate -- other fields and homogeneity -- or it can be intentionally different.
[0013] Then, in a part with the air supplying opening carried out by the two or more division, by changing the both sides of temperature and humidity with other parts of an air supplying opening, it is canceled because canceling the ununiformity of the thickness by the fluidity of coating liquid being uneven by making the fluidity of coating liquid into homogeneity operates the fluidity of coating liquid intentionally so that the ununiformity of the thickness by elements other than a fluidity may also negate the element from the first.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EXAMPLE

[Example] Hereafter, the example of this invention is explained based on a drawing. Drawing 1 is the sectional view of the 1st revolution coater used for the revolution method of application concerning this invention. This revolution coater mainly consists of a body 20 of a coater, and air-current supply duct equipment 30.
[0015] The body 20 of a coater is equipped with the spin chuck 2 which supports the semiconductor wafer 1 (it is only described as a wafer below), the spindle 3 for rotating a wafer 1 by thousands revolutions, a rectification means 4 to prepare an air current in the lower part of a wafer 1, the cup 5 constituted so that a wafer 1 may be covered from a perimeter, and the exhaust port 6 which is open for free passage for the exhaust air means (not shown) for exhausting the air current in this cup 5. When it is arranged in the condition that the nozzle for coating liquid supply of a photoresist etc. (not shown) placed the delivery upside down, this nozzle moves above a wafer 1 when applying coating liquid on a wafer 1, and not applying above a spin chuck 2, it evacuates to the location on the side of a cup 5.
[0016] On the other hand, the air-current supply duct equipment 30 which divides and supplies an air current to the top face of a wafer 1 at plurality is formed above the body 20 of a coater. This air-current supply duct equipment 30 is equipped with the periphery air-current supply duct 11 on the front face of a wafer 1 which supplies an air current to a periphery comparatively while it is formed in the outside of the core air-current supply duct 9 of the shape of a cylinder on the front face of a wafer 1 which supplies an air current to a core comparatively, and this core air-current supply duct 9 in the shape of a concentric circle.
[0017] The center-section air-current supply duct 9 is opened for free passage by the 1st temperature and the humidity control unit 7, and the air current air-conditioned in this unit 9 passes the punching plate 8, and is mainly supplied toward the core of a wafer 1 from the 1st air supplying opening 10. The punching plate 8 prepared in the center-section air-current supply duct 9 is carrying out the role of the flow resistance for supplying an air current uniformly from the center-section air-current supply duct 9. Moreover, the 2nd temperature and the humidity control unit 12 are open for free passage, and the periphery air-current supply duct 11 is air-conditioning the air current so that the both sides of temperature and humidity may differ from the air current air-conditioned in above-mentioned 1st temperature and humidity control unit 7. And this air-conditioned air current passes a slit 13, and is mainly supplied toward the periphery of a wafer 1 from the 2nd air supplying opening 14. In the 2nd air supplying opening 14, this slit 13 carries out rate-limiting [of the air current in the periphery air-current supply duct 11], and it is prepared from the whole opening surface of the 2nd air supplying opening 14 so that homogeneity can be supplied if possible, so that it may not charge strongly only the neighborhood near the free passage section with the 2nd temperature and the humidity control unit 12.
[0018] Furthermore, a migration means (not shown) to move the air-current supply duct equipment 30 constituted as mentioned above to locations other than the upper part of a wafer 1 and the upper part is established. This migration means moves air-current supply duct equipment 30 above a wafer 1, when supplying an air current to a wafer 1, and when it does not supply, it is made to evacuate it to locations other than the upper part of a wafer 1.

[0019] In addition, the temperature of the air current supplied although the air current currently air-conditioned in the 1st temperature, the humidity control unit 7, and the 2nd temperature and a humidity control unit 12 is controlled so that the both sides of temperature and humidity differ, respectively is 20-30 degrees C, humidity is the range of 40 - 50%RH (relative humidity), and the rate of flow is 0. several m/min (dozens cm/min). It is desirable to make it extent.
[0020] Next, the revolution method of application concerning this invention using the revolution coater of the above 1st is explained. First, before starting a spindle 3, a wafer 1 is carried in in a revolution coater with the conveyance means which is not illustrated, and it lays on a spin chuck 2, and holds by performing vacuum adsorption etc. And a nozzle is moved above a wafer 1. At this time, air-current supply duct equipment 30 is evacuated to the location on the side of a cup 5, and extent which a wafer 1 moves [carrying in or / nozzle] in the upper location of a cup 5.
[0021] In this condition, the coating liquid of the specified quantity is applied on a wafer 1 from the delivery of a nozzle, and a nozzle is immediately evacuated from the wafer 1 upper part after that. Or coating liquid is supplied operating a spindle 3 previously and rotating a wafer 1 comparatively at a low speed (for example, 1000 or less rpm), and a nozzle is immediately evacuated from the upper part of a substrate 1 after that. Then, the evacuated air-current supply duct equipment 30 moves above a wafer 1 with a migration means, and descends to about 20mm on the front face of a wafer 1 further.
[0022] Subsequently, the air current which were classified in the radius-of-gyration direction of a wafer 1 in the shape of a concentric circle and which changed the both sides of temperature and humidity for every field is supplied. for example, in being easy to evaporate a solvent component by the periphery of a wafer 1 as compared with the core of a wafer 1 In the relative comparison between the 1st and 2nd both temperature and humidity control unit beforehand An air current with low humidity is air-conditioned at an elevated temperature with the 1st temperature and the humidity control unit 7, and the humid air current is air-conditioned at low temperature with the 2nd temperature and the humidity control unit 12, respectively, and the air-conditioned air current is supplied to the core and periphery of a wafer 1, respectively. If it does so, it will cross all over a wafer 1 and evaporation of the solvent component from coating liquid will become homogeneity. On the other hand, most air currents supplied to the wafer 1 are exhausted from an exhaust port 6 by the exhaust air means.
[0023] In addition, since the both sides of temperature and humidity are somewhat mixed while flowing even to a wafer 1, in directly under [of the 1st air supplying opening 10 and the 2nd air supplying opening 14 / boundary], as for the air current supplied from the 1st air supplying opening 10 and the 2nd air supplying opening 14, the thickness of the coating liquid on a wafer 1 does not change suddenly. Moreover, although there is a possibility of producing the inconvenience by changing like producing the ununiformity of thickness when an air current is confused on the boundary of air currents where a flow rate is different, with a means to control the flow rate of an air current by the truncated-cone-like guide means like a Prior art, there is no possibility of producing turbulence of an air current in this invention controlled so that the both sides of temperature and humidity differ.
[0024] The above is the revolution method of application concerning this invention, as a result of evaporation of the solvent component from coating liquid becoming homogeneity, it goes across thickness all over a wafer 1, and it becomes homogeneity. In addition, what is necessary is for a process which supplies an air current to explain, after applying coating liquid on a wafer 1, but just to prepare above-mentioned this example more nearly up than the space where it is not necessary to make move air-current supply duct equipment 30 with a migration means, and is the upper part of a wafer 1 and a nozzle moves, where air-current supply duct equipment 30 is fixed when always supplying the air current which changed the both sides of temperature and humidity to the wafer 1.
[0025] Moreover, the revolution coater used for the revolution method of application concerning this invention can consider various equipments. Drawing 2 is the sectional view of the 2nd revolution coater used for the revolution method of application concerning this invention. A different point from the 1st revolution coater is a point of having formed the air-current exhaust duct 16 between the core air-current supply duct 9 and the periphery air-current supply duct

11. And the air current which was made into the shape of a concentric circle by the two or more division in the radius-of-gyration direction of a wafer 1 and which was controlled so that the both sides of temperature and humidity differed for every field is supplied with this revolution coater as well as the revolution method of application which used the 1st revolution coater. However, although most air currents supplied to the wafer 1 are exhausted from an exhaust port 6, it is exhausted by the exhaust air means which a part of air current does not illustrate through the slit 17 and damper 15 which are formed in the air-current exhaust duct 16 from an exhaust port 18. In addition, in order that a damper 15 may adjust an exhaust stream, the slit 17 is formed, respectively, in order to carry out rate-limiting [of the exhaust stream].

[0026] Drawing 3 is the sectional view of the 3rd revolution coater used for the revolution method of application concerning this invention. A different point from the 1st revolution coater is a point of having established from the perimeter the air-current supply duct 19 which supplies an air current for the air current air-conditioned in the 1st temperature and the humidity control unit 7 to the body of coater 20 whole instead of and the body 20 of a coater for the wrap body material 21. [the center-section air-current supply duct 9] And in this revolution coater, the air current air-conditioned in the 1st temperature and the humidity control unit 7 passes the punching plate 8, and is supplied to the wafer 1 whole, and the air current air-conditioned in the 2nd temperature and the humidity air conditioning unit 12 is supplied to the annular field according to the plane view of the boundary of the core on a wafer 1, and a periphery through a slit 13.

[0027] Like [the revolution method of application using which revolution coater] the case where the 1st revolution coater is used, it goes across thickness all over a substrate, and it becomes homogeneity.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The sectional view of the 1st revolution coater using the revolution method of application concerning this invention is shown.
[Drawing 2] The sectional view of the 2nd revolution coater used for the revolution method of application concerning this invention is shown.
[Drawing 3] The sectional view of the 3rd revolution coater used for the revolution method of application concerning this invention is shown.
[Description of Notations]
1 Wafer
7 1st Temperature and Humidity Control Unit
9 Center-Section Air-Current Supply Duct
10 1st Air Supplying Opening
11 Periphery Air-Current Supply Duct
12 2nd Temperature and Humidity Control Unit
14 2nd Air Supplying Opening
20 Body of Coater
30 Air-Current Supply Duct Equipment

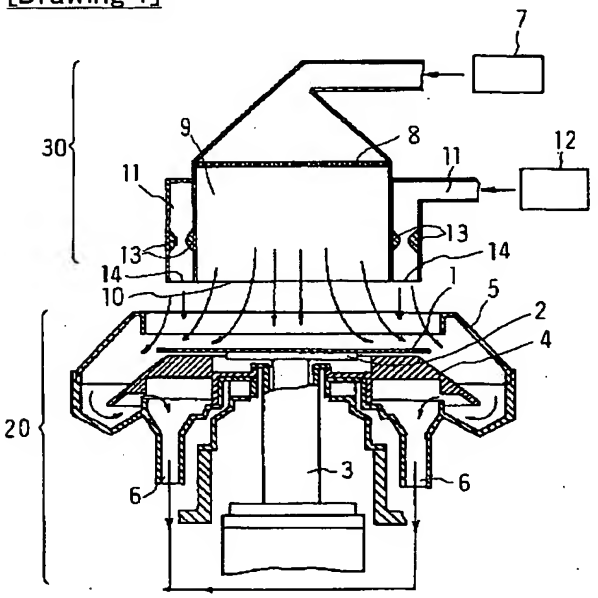
[Translation done.]

* NOTICES *

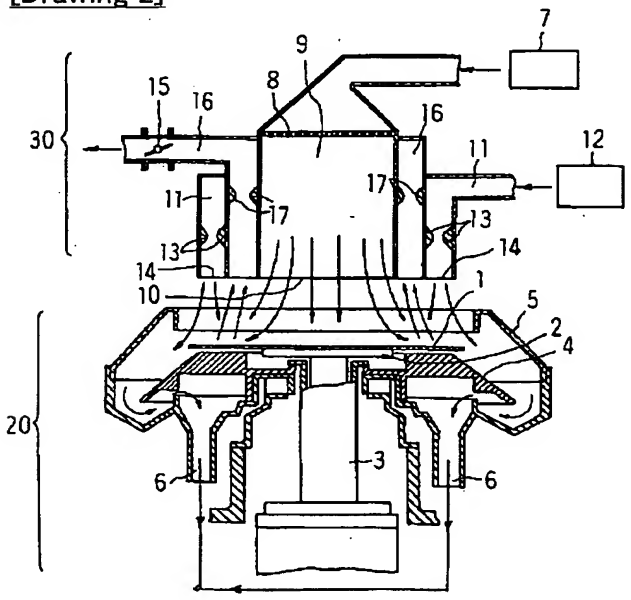
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

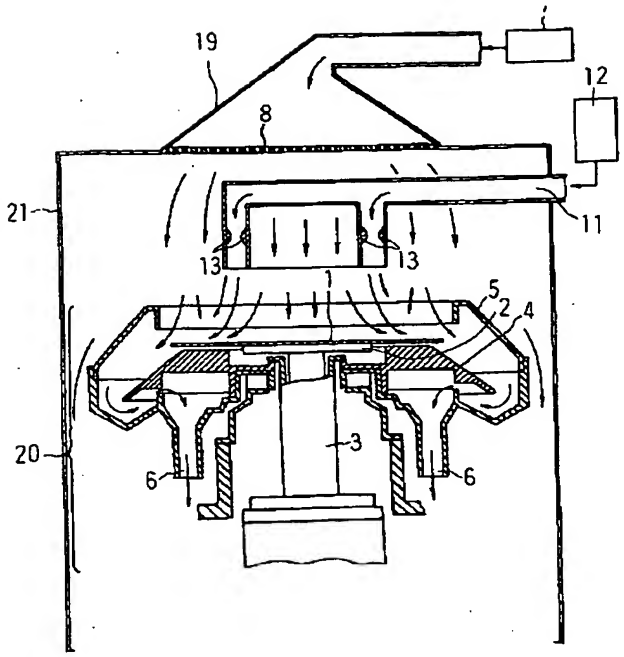
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平5－166712

(43)公開日　平成５年(1993)７月２日

(51)Int.Cl.[5]	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｈ０１Ｌ　21/027				
Ｂ０５Ｄ　1/40		Ａ　8616－4D		
Ｇ０３Ｆ　7/16	５０２			
		7352－4M	Ｈ０１Ｌ　21/30	３６１　Ｃ

審査請求　未請求　請求項の数１(全　５　頁)

(21)出願番号　特願平3－335061

(22)出願日　平成３年(1991)12月18日

(71)出願人　000207551
大日本スクリーン製造株式会社
京都府京都市上京区堀川通寺之内上る４丁目天神北町１番地の１

(72)発明者　矢部　学
京都府京都市伏見区羽束師古川町322番地
大日本スクリーン製造株式会社洛西工場内

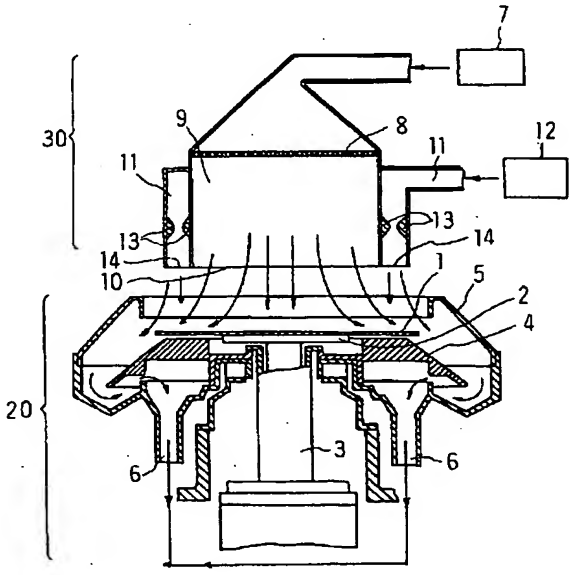
(74)代理人　弁理士　池内　寛幸　(外１名)

(54)【発明の名称】　回転塗布方法

(57)【要約】

【目的】　基板の回転半径方向に複数区分した領域ごとに、温度と湿度の双方が異なるように制御された気流を基板に供給することによって、均一な薄膜を形成する回転塗布方法に関する。

【構成】　気流供給ダクト装置３０は、ウエハ１の表面上の比較的中心部に気流を供給する円筒状の中心部気流供給ダクト９と、ウエハ１の表面上の比較的周辺部に気流を供給する周辺部気流供給ダクト１１とを備えている。そして、中心部気流供給ダクト９と周辺部気流供給ダクト１とから、温度と湿度が異なるように制御された気流をそれぞれウエハ１に供給して均一な厚さの薄膜を形成する。



1

【特許請求の範囲】
【請求項１】　基板を回転することによって、基板へ供給した塗布液で基板上に薄膜を形成する回転塗布方法において、基板の回転中心に対して、同心円状に複数分割した給気口を有する分割給気手段によって、基板の回転半径方向に複数区分した領域ごとに、温度と湿度の双方が異なるように制御された気流を基板に供給することを特徴とする回転塗布方法。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明は、半導体ウエハ、液晶表示装置用ガラス基板、光ディスク用ガラス基板、フォトマスク用ガラス基板といった各種の基板に、フォトレジスト材、ＳＯＧ材、ドーパント材といった塗布液を塗布する回転塗布方法に関し、特に、基板の上方から清浄な空気等の気流を供給して薄膜の厚さを均一にする回転塗布方法に関する。
【０００２】
【従来の技術】従来から、基板に塗布液を回転塗布する際には、基板の周辺の環境条件（温度や湿度や風速等）をできるだけ均一にするのが一般的な傾向である。しかし、単に基板の周辺の環境条件を均一にしても、実際には基板の回転中では、基板の中心部と周辺部とで風切りの程度が異なるので、基板表面上において必ずしも環境条件は一定ではない。このため、基板表面の比較的周辺部では塗布液の溶剤成分が揮発し易く、結果的に粘度の高い塗布液を供給したような状況であるから、拡散流動性が下がって遠心力で振り切られる作用が低下して、周辺部で膜が厚くなることがある。また、ある場合には、同じように拡散流動性が下がっても遠心力で飛散している塗布液が基板の周辺部にある塗布液を強く引っ張って、逆に周辺部で膜が薄くなることもある。
【０００３】特に、最近では、半導体ウエハの８インチ化等の基板の大口径化に伴って、基板の周辺の環境条件を均一にするだけでは、均一な厚さの薄膜を形成することがますます困難になってきている。
【０００４】そこで、膜厚を均一にする方法としては、基板の上方からの気流の流量を制御することによって均一な膜厚を形成するもの（特開昭６３－７２３７３号公報）が提案されている。これは、基板の周囲を覆うカップ内に、基板の上方を覆うように円錐台状のガイド手段を設けて気流を複数に分割し、それぞれの気流の流量を流量調節手段で制御することによって、流量を基板の回転半径方向に異なるように気流を供給して、基板全面に均一な膜厚を形成しようとしている。
【０００５】また、他の従来例としては、特開昭６２－２２５２６８号公報記載の技術が知られている。この技術は、一旦基板に供給された洗浄ガスを独立に排気する方向と排気量とを制御する排気構造を設けることによって、膜厚の均一性を向上しようとするものである。

2

【０００６】
【発明が解決しようとする課題】しかしながら、このような従来の塗布方法にあっては、次のような問題点を有している。
【０００７】即ち、従来の技術は、気流を複数に分割しそれぞれの気流の流量を制御したり、あるいは、独立に気流の排気方向と排気量とを制御しているが、実際には均一な膜厚を形成するように意図した通り気流の流量や排気量を制御することは難しい。これは、基板上では流量や排気量の制御された複数の異なる気流が互いに影響を受けあって、気流の流量や排気量の制御が基板の表面に及ばないのが原因となっている。その結果、基板の回転半径方向に流量や排気量を違えた気流を供給するだけでは、均一な膜厚を形成することが困難であるという問題がある。
【０００８】本発明は、このような従来の問題点を解決するためになされたものであって、基板の回転半径方向に、温度と湿度の双方が異なるように制御された気流を基板に供給することによって、均一な薄膜を形成する回転塗布方法を提供することを目的とする。
【０００９】
【課題を解決するための手段】上記目的を達成するために、本発明に係る回転塗布方法は、基板を回転することによって、基板へ供給した塗布液で基板上で薄膜を形成する回転塗布方法において、基板の回転中心に対して同心円状に複数分割した給気口を有する分割給気手段によって、基板の回転半径方向に同心円状に複数区分した領域ごとに、温度と湿度の双方が異なるように制御された気流を基板に供給するようにしている。
【００１０】
【作用】本発明に係る回転塗布方法によれば、分割供給手段が基板の回転中心に対して同心円状に複数分割した給気口から、基板の回転半径方向に複数区分した領域ごとに、温度と湿度の双方が異なるように制御された気流を基板に供給するので、膜厚の均一性を向上させることができる。すなわち、通常大気開放系の雰囲気でその全圧は大気圧であるから、ここで仮に複数区分された給気口のある部分において、気流の湿度を高く、即ち水蒸気圧を高くすると、そのような気流に触れる基板上の領域では、基板の周囲は大気圧に開放された状態にあるので、塗布液が親水性であろうと親油性であろうと、その溶剤成分の蒸気分圧が下がる。他方、仮に給気流の湿度を低くすると、塗布液の溶剤成分の蒸気分圧が上がる。
【００１１】また、給気口のある部分において、仮に給気流の温度を高くすると、そのような気流に触れる基板上の領域では、基板上の塗布液の溶剤成分の蒸気分圧は上がり、仮に給気流の温度を低くすると、塗布液の溶剤成分の蒸気分圧は下がる。
【００１２】このため、複数区分された給気口のある部分において、温度と湿度の双方を給気口の他の部分と異

なるように制御された気流を供給することにより、従来例とと比較して、そのような気流に触れる基板上の領域では、塗布液の溶剤成分が気化する程度に変わり、基板上のその領域での塗布液の流動性を他の領域と均一に、あるいは、意図的に違うようにできる。

【００１３】そこで、複数区分された給気口のある部分において、温度と湿度の双方を給気口の他の部分と違えることによって、塗布液の流動性が不均一であることによる膜厚の不均一を塗布液の流動性を均一にすることで解消することはもとより、流動性以外の要素による膜厚の不均一も、その要素を打ち消すように意図的に塗布液の流動性を操作することで解消される。

【００１４】

【実施例】以下、本発明の実施例について図面に基づいて説明する。図１は、本発明に係る回転塗布方法に用いる第１の回転塗布装置の断面図である。この回転塗布装置は、塗布装置本体２０と気流供給ダクト装置３０とから主に構成されている。

【００１５】塗布装置本体２０は、半導体ウエハ１（以下単にウエハと記す）を支持するスピンチャック２と、ウエハ１を数千回転で回転させるためのスピンドル３と、ウエハ１の下方で気流を整える整流手段４と、ウエハ１を周囲から覆うように構成しているカップ５と、このカップ５内の気流を排気するための排気手段（図示せず）に連通している排気口６とを備えている。スピンチャック２の上方には、フォトレジスト等の塗布液供給用のノズル（図示せず）が吐出口を下向きにした状態で配置され、このノズルは、ウエハ１上に塗布液を塗布するときにはウエハ１の上方に移動し、塗布しないときにはカップ５の側方上の場所に退避するようになっている。

【００１６】一方、塗布装置本体２０の上方には、ウエハ１の上面に気流を複数に分割して供給する気流供給ダクト装置３０が設けられている。この気流供給ダクト装置３０は、ウエハ１の表面上の比較的中心部に気流を供給する円筒状の中心部気流供給ダクト９と、この中心部気流供給ダクト９の外側に同心円状に形成されていると共にウエハ１の表面上の比較的周辺部に気流を供給する周辺部気流供給ダクト１１とを備えている。

【００１７】中央部気流供給ダクト９は、第１温度・湿度調整ユニット７に連通されており、このユニット９で空調された気流は、パンチングプレート８を通過して第１給気口１０から主にウエハ１の中心部に向かって供給される。中央部気流供給ダクト９内に設けられているパンチングプレート８は、中央部気流供給ダクト９から気流をむらなく供給するための流体抵抗の役割をしている。また、周辺部気流供給ダクト１１は、第２温度・湿度調整ユニット１２に連通されており、上記の第１温度・湿度調整ユニット７で空調された気流とは温度と湿度の双方が異なるように気流を空調している。そして、この空調された気流は、スリット１３を通過して第２給気口１４から主にウエハ１の周辺部に向かって供給される。このスリット１３は、第２給気口１４において、第２温度・湿度調整ユニット１２との連通部に近い辺りだけが強く給気されることがないように、周辺部気流供給ダクト１１内の気流を律速して、第２給気口１４の開口全面から、なるべく均一に供給できるように設けられているものである。

【００１８】さらに、上記のように構成された気流供給ダクト装置３０をウエハ１の上方と上方以外の場所とに移動させる移動手段（図示せず）が設けられている。この移動手段は、ウエハ１に気流を供給するときは気流供給ダクト装置３０をウエハ１の上方に移動し、供給しないときはウエハ１の上方以外の場所に退避させるようになっている。

【００１９】なお、第１温度・湿度調整ユニット７及び第２温度・湿度調整ユニット１２で空調されている気流は、それぞれ温度と湿度の双方が異なるように制御されているが、供給される気流の温度は２０～３０℃、湿度は４０～５０％ＲＨ（相対湿度）の範囲で、流速は０．数m/min(数十cm/min) 程度にしておくのが望ましい。

【００２０】次に上記第１の回転塗布装置を用いた本発明に係る回転塗布方法を説明する。まず、スピンドル３を始動させる前に、図示しない搬送手段によりウエハ１を回転塗布装置内に搬入し、スピンチャック２上に載置して真空吸着等を行って、保持する。そして、ノズルをウエハ１の上方に移動させる。このとき、気流供給ダクト装置３０はカップ５の側方上の位置か、ウエハ１の搬入やノズル移動が可能な程度にカップ５の上方の場所に退避している。

【００２１】この状態で、ノズルの吐出口より所定量の塗布液をウエハ１上に塗布し、その後すぐにノズルはウエハ１上方から退避する。あるいは、先にスピンドル３を作動させてウエハ１を比較的低速（例えば、１０００ｒｐｍ以下）で回転しながら塗布液を供給し、その後すぐにノズルを基板１の上方から退避させる。その後、退避していた気流供給ダクト装置３０は移動手段によりウエハ１の上方に移動し、さらに、ウエハ１の表面上約２０ｍｍまで降下する。

【００２２】次いで、ウエハ１の回転半径方向に同心円状に複数区分した領域ごとに、温度と湿度の双方を違えた気流を供給する。例えば、ウエハ１の中心部と比較してウエハ１の周辺部では溶剤成分の気化し易い場合には、第１と第２の両温度・湿度調整ユニット間での相対比較において、あらかじめ、第１温度・湿度調整ユニット７で高温で湿度の低い気流を空調し、また第２温度・湿度調整ユニット１２で低温で湿度の高い気流をそれぞれ空調しておき、その空調した気流をウエハ１の中心部と周辺部にそれぞれ供給する。そうすると、ウエハ１の全面に渡って塗布液からの溶剤成分の気化が均一になる。一方、ウエハ１に供給された気流の大部分は、排気

手段により排気口６から排気される。

【００２３】なお、第１給気口１０と第２給気口１４とから供給する気流は、温度と湿度の双方ともウエハ１まで流れる間に多少混じり合うので第１給気口１０と第２給気口１４の境界直下において、ウエハ１上の塗布液の膜厚が急に変化することはない。また、従来の技術のように円錐台状のガイド手段で気流の流量を制御する手段では、流量が違う気流どうしの境界にて気流が乱れることにより膜厚の不均一を生じる等のように、違えることによる不都合を生じるおそれがあるが、温度と湿度の双方が異なるように制御する本発明では、気流の乱れを生じるおそれがない。

【００２４】以上が本発明に係る回転塗布方法であり、塗布液からの溶剤成分の気化が均一になった結果、膜厚はウエハ１の全面に渡って均一になる。なお、上記本実施例は、塗布液をウエハ１上に塗布した後に気流を供給するような工程で説明したが、常時、ウエハ１に温度と湿度の双方を違えた気流を供給する場合には、気流供給ダクト装置３０を移動手段で移動させる必要はなく、ウエハ１の上方であってノズルが移動する空間より上方に、気流供給ダクト装置３０を固定した状態で設けておけばよい。

【００２５】また、本発明に係る回転塗布方法に用いる回転塗布装置は、種々の装置が考えられる。図２は、本発明に係る回転塗布方法に用いる第２の回転塗布装置の断面図である。第１の回転塗布装置と異なる点は、中心部気流供給ダクト９と周辺部気流供給ダクト１１との間に気流排気ダクト１６を設けている点である。そして、この回転塗布装置でも、第１の回転塗布装置を用いた回転塗布方法と同じように、ウエハ１の回転半径方向に同心円状に複数区分された領域ごとに、温度と湿度の双方が異なるように制御された気流を供給する。しかし、ウエハ１に供給された気流の大部分は排気口６から排気されるが、気流の一部が図示しない排気手段によって、排気口１８から気流排気ダクト１６内に設けられているスリット１７とダンパ１５とを介して排気される。なお、ダンパ１５は排気流を調節するために、また、スリット１７は排気流を律速するためにそれぞれ設けられているものである。

【００２６】図３は、本発明に係る回転塗布方法に用いる第３の回転塗布装置の断面図である。第１の回転塗布装置と異なる点は、中央部気流供給ダクト９の代わりに、第１温度・湿度調整ユニット７で空調された気流を塗布装置本体２０全体に気流を供給する気流供給ダクト１９と、塗布装置本体２０を周囲から覆う円筒部材２１と、を設けている点である。そして、この回転塗布装置では、第１温度・湿度調整ユニット７で空調された気流がパンチングプレート８を通過してウエハ１全体に供給され、第２温度・湿度空調ユニット１２で空調された気流はスリット１３を介して、ウエハ１上の中心部と周辺部との境界の平面視で環状の領域に供給している。

【００２７】いずれの回転塗布装置を用いた回転塗布方法でも、第１の回転塗布装置を用いた場合と同様に、膜厚は基板全面に渡って均一になる。

【００２８】

【発明の効果】以上説明したように、本発明によれば、基板の回転半径方向に同心円状に複数区分した領域ごとに、温度と湿度の双方が異なるように制御された気流を供給するので、基板の全面に渡って塗布液からの溶剤成分の気化が均一になり、あるいは、膜厚を不均一にする何等かの要素を打ち消すように意図的に溶剤成分の気化を高めることや低くすることができ、この結果、基板上に均一な厚さの薄膜を形成することができる。

【図面の簡単な説明】

【図１】本発明に係る回転塗布方法を用いた第１の回転塗布装置の断面図を示す。

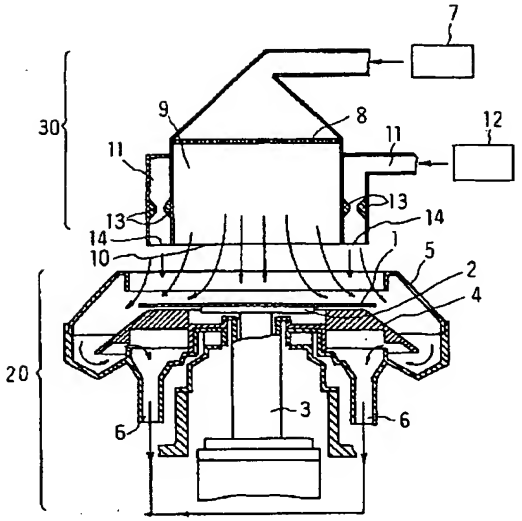
【図２】本発明に係る回転塗布方法に用いた第２の回転塗布装置の断面図を示す。

【図３】本発明に係る回転塗布方法に用いた第３の回転塗布装置の断面図を示す。

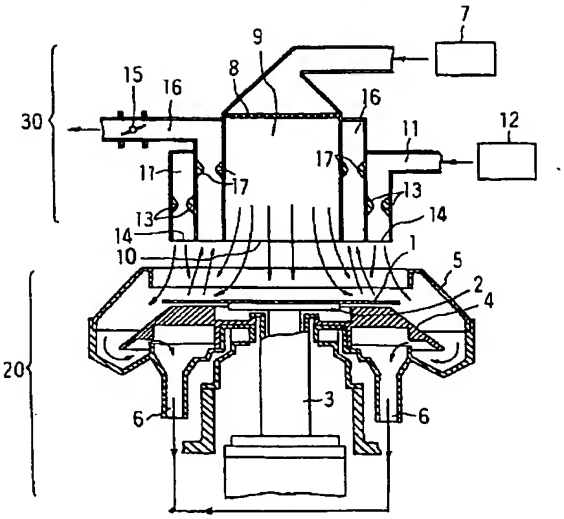
【符号の説明】

１　ウエハ
７　第１温度・湿度調整ユニット
９　中央部気流供給ダクト
１０　第１給気口
１１　周辺部気流供給ダクト
１２　第２温度・湿度調整ユニット
１４　第２給気口
２０　塗布装置本体
３０　気流供給ダクト装置

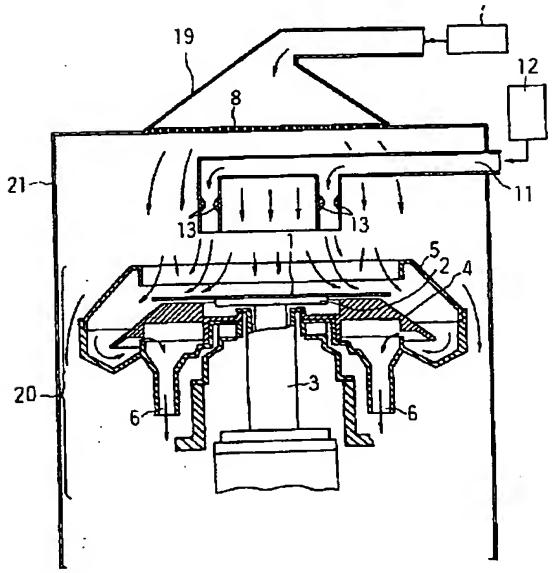
【図１】



【図２】



【図３】



【手続補正書】
【提出日】平成４年１月２８日
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】００１２
【補正方法】変更
【補正内容】
【００１２】このため、複数区分された給気口のある部分において、温度と湿度の双方を給気口の他の部分と異なるように制御された気流を供給することにより、他の部分と異ならせない場合と比較して、そのような気流に触れる基板上の領域では、塗布液の溶剤成分が気化する程度が変わり、基板上のその領域での塗布液の流動性を、他の領域と均一に、あるいは意図的に違うようにできる。

PATENT ABSTRACTS OF JAPAN

(11)Publication number : **04-174848**
(43)Date of publication of application : **23.06.1992**

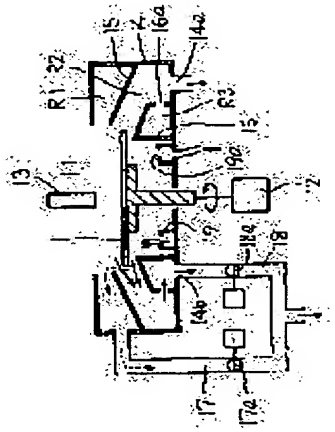
(51)Int.CI. G03F 7/16
B05C 11/08
H01L 21/027

(21)Application number : **02-303549**
(22)Date of filing : **08.11.1990**

(71)Applicant : **FUJITSU LTD**
(72)Inventor : **KUMAGAI OSAHISA**

(54) REGIST COATING DEVICE

(57)Abstract:
PURPOSE: To obtain a regist coating device which provides a regist film excellent in film thickness uniformity with no adhesion of regist mist by forming a first space above a second space enclosing the outer circumference of a substrate, and concurrently providing an air feed means below the back surface of the substrate.
CONSTITUTION: A device is furnished with an envelope 14 which encloses a substrate 1 and is opened at a section above the coating surface of the substrate, a ring shaped partitioning plate 15 partitioning the inside of the envelope into an upper and a lower section, a first exhaust passage 17, and with a second exhaust passage 18 wherein the inner circumferential section of the partitioning plate is close to the outer circumferential section of the substrate while being positioned higher than the coating surface of the substrate, both a first place R1 formed by the partitioning plate 15 above the partitioning plate and a second place R2 similarly formed under the partitioning plate are communicated with the first exhaust passage 17 and the second exhaust passage 18 respectively, and the exhaust passage 18 is furnished with a closing means 18a. Furthermore, an air feed means 19 is constituted to be disposed under the substrate in such a way that air is fed toward the circumferential section of the back surface of the substrate 1. By this constitution, when air in the space R1 is discharged during the time when it is suspended to discharge air from the space R2, air flow is generated from the back surface side of the substrate to the space R1 through the circumference of the substrate, this thereby prevents regist mist from being splashed onto the coating surface of the substrate.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]